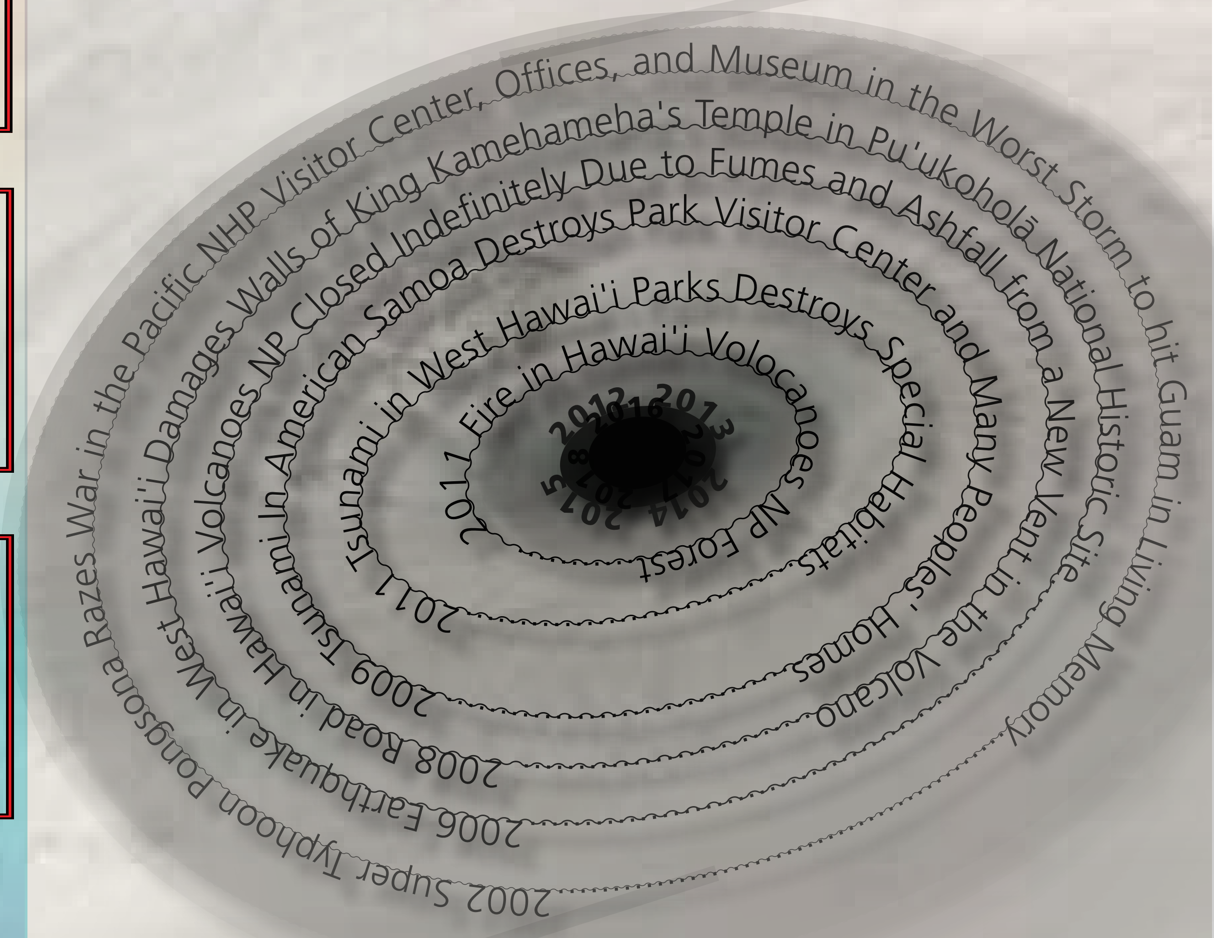
Inventory & Monitoring
Pacific Island Network

National Park Service
U.S. Department of the Interior

Pacific Island Network Quarterly

Natural Disasters in Pacific Island National Parks



Quarterly Newsletter of the Pacific Island Network (PACN) Inventory & Monitoring Program
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The National Park Service (NPS) has implemented natural resource inventory and monitoring on a servicewide basis to ensure all park units possess the resource information needed for effective, science-based management, decision-making, and resource protection.

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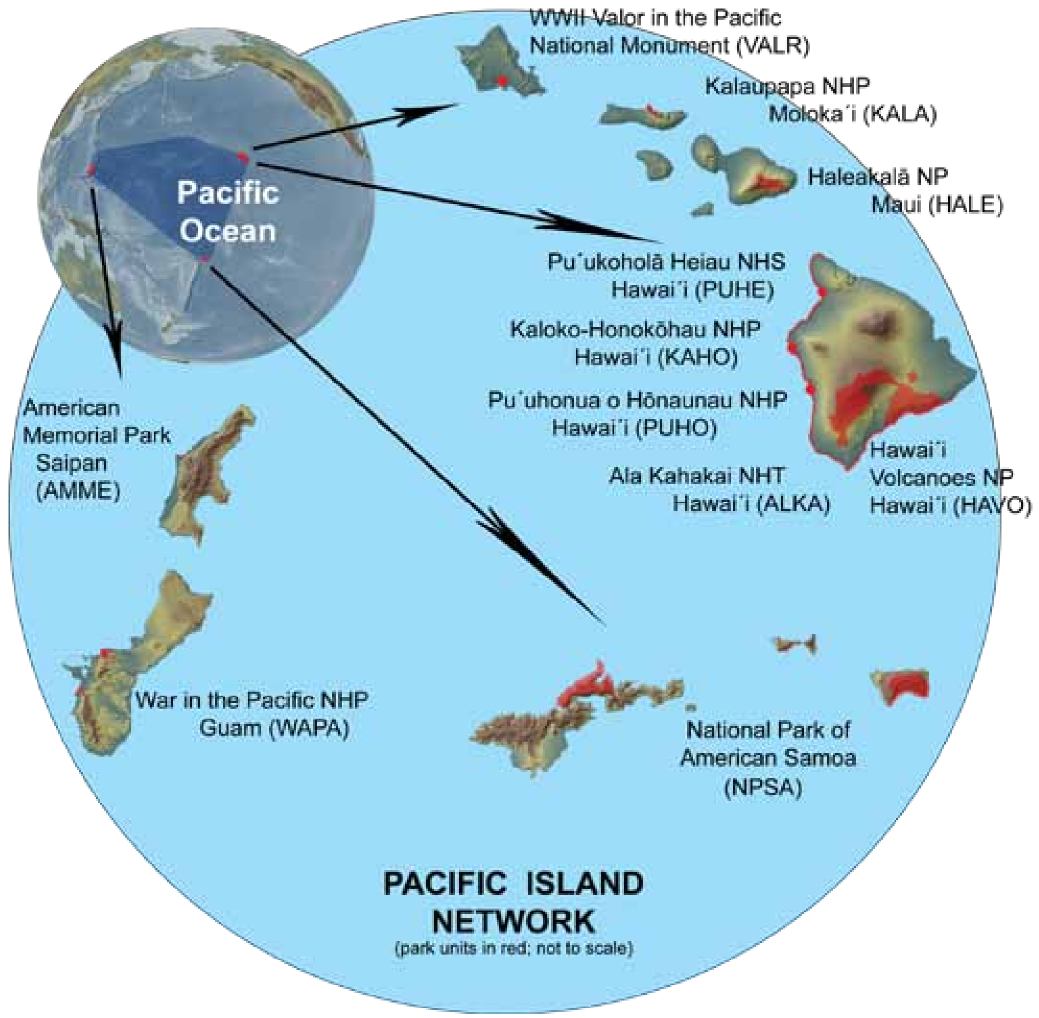


Monitoring Schedule

July
Water Quality Monitoring at KAHO, HALE, and KALA
Freshwater Animals Monitoring at HALE
Benthic and Marine Fish Monitoring at KALA
Landbirds Monitoring at NPSA
Plant Communities and Invasive Plants Monitoring at HAVO
Plant Communities Monitoring at KAHO
Vegetation Mappaing at HALE

Aug.
Water Quality Monitoring at PUHO, PUHE, ALKA, KALA, WAPA, AMME
Freshwater Animals Monitoring at KALA
Groundwater Monitoring at KAHO and AMME
Landbirds Monitoring at NPSA
Plant Communities and Invasive Plants Monitoring at HAVO
Vegetation Mapping at HALE

Sept.
Water Quality Monitoring at NPSA
Plant Communities and Invasive Plants Monitoring at HAVO
Vegetation Mapping at HALE

Program Manager's Note

Every newsletter we publish has a statement about why we monitor natural resources in the parks (see the gold column on page 2), but this issue highlights another benefit of monitoring – resource change and response after catastrophic events like wildfire and tsunamis. Although resources may be damaged or destroyed, disturbances and ecological recovery are part of the natural cycle that we must understand. With baseline data from monitoring collected before and after a disturbance, we can know exactly what the toll is on resources and anticipate how fast a recovery will occur.

Ecosystems evolve with disturbances and these events can improve habitat and biodiversity, even though the initial destruction of resources can be catastrophic. Forest fires are a great example and many of us in the National Park Service remember the huge controversy in 1988 when 36% (790,000 acres) of Yellowstone burned. The NPS was publicly flogged for its fire management polices. However, follow-up research showed that this large scale disturbance played a key role for forest floor herbs and the establishment of new aspen clones, an important habitat species. Park ecosystems recovered and visitors returned.

In pristine ecosystems with a normal disturbance regime, a healthy recovery will usually follow a large disturbance. However, invasive species, stressed ecosystems, and a changing climate mean that we may need active management to protect resources —like weed control after a hurricane or fire opens up the forest floor to invaders. Monitoring gives us the solid data to know what the resource was before the catastrophe, how it is recovering, and what we can do to help.

—G. Kudray, NPS
PACN Program Manager

Staff Update

In the most dramatic staffing shift in the history of the Pacific Island Network Inventory and Monitoring Program, five people have left and seven have joined or rejoined us.

First, the parting news.

Five of our team members have accepted positions outside of the Pacific Island Network. Our Administrative Technician for the past four years, **Donna Ashenmacher**, has moved on to a position with NOAA in Oregon. Also seeking new challenges is the original PACN Aquatic Ecologist, **Tahzay Jones.** He will be starting another NPS position in Alaska this summer.

Biological Science Technicians **Lindsey Kramer** and **Adam Mehlhorn** have left for new adventures on the French Frigate Shoals and in Philadelphia, respectively. Finally, long-time Volunteer **Meghan Jerolaman** has also turned in her rubber boots and set off for new horizons.

All five of these people have contributed immensely to the success of the Inventory & Monitoring Program. We wish them all the best with the next phase of their careers.

So, that brings us to the good news. The new team members.

The I&M vegetation monitoring team has continued to staff up. **Laura Arnold** returned to the Big Island for the vegetation monitoring field season in Kahuku at HAVO. She is joined by fellow Biological Science Technicians **Jacob Gross** and **Forrest Phifer**. Volunteer **Keith Burnett** rounds out the this summer's vegetation crew.

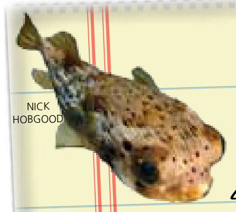
As the summer rolls on, three more people will join the ranks of the National Park Service.

Danielle Gross rejoins the I&M program after several years hiatus. She will be the aquatic Biological Science Technician stationed at KAHO. **Cory Nash** officially transitions from the CESU Science Communicator to the NPS Science Communications Coordinator. And finally, **Brian Sylvester** will be filling the big shoes that Donna left behind as the program's Administrative Technician.

New Science Education Resources

Coral Reef and Climate Change Educational Website (more in next newsletter):
http://www1.coseecoastal-trends.net/modules/coral_reefs_and_climate_change/get_started/

Landscape Dynamics Monitoring Video:
http://www.youtube.com/watch?v=0LaDQIqNFQc



Tsunami Hits Anchialine Pools

"Puffy" is his name. A large spiny balloonfish had become the new unofficial mascot of Pu'uhonua o Hōnaunau National Historical Park (PUHO). As a result of the March 11 tsunami, Puffy and many other marine fish were swept up in the waves and landed in ecologically and culturally important brackish-water anchialine pools along the Kona Coast on the island of Hawai'i.

The Kona coast showed major signs of tsunami damage. The NPS aquatic biology team arrived at PUHO for our quarterly water sampling trip at the end of April. At one of the fish pond sites in the royal court, the tide was extremely low when we first saw some of the damage. The rock wall was in pieces, sediment had shifted, and a marine balloonfish was in this inland pool. We knew we had to help Puffy. After finishing the water quality sampling, we grabbed a seine, dip nets, an action packer, some help, and hopped into the pool; boots and all.

The biggest concern with Puffy was his defense mechanism. Like all porcupinefish he might "puff up" when threatened. Unfortunately, this stresses the fish and could potentially kill it. But Puffy had no food source in the pool and could not survive there for very long. We knew we had to act fast.

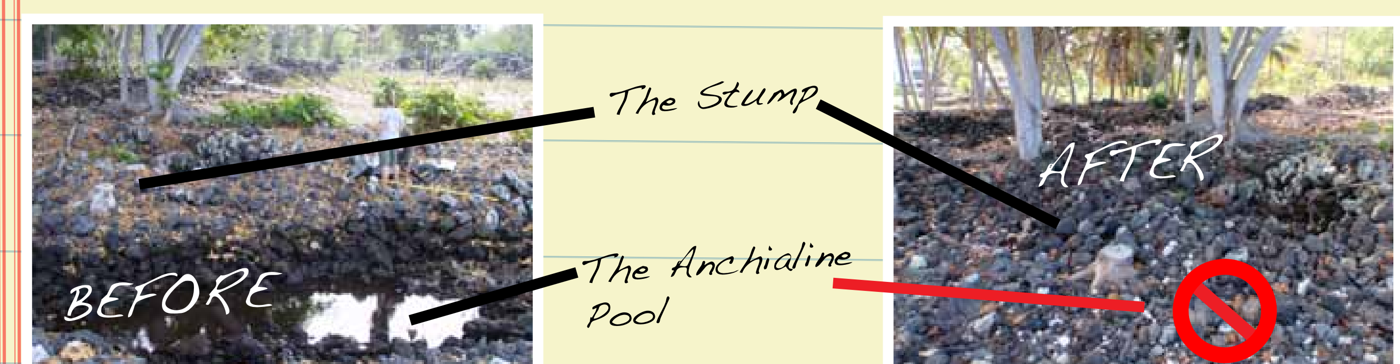
We seined the fish across the pond to the shallows. Then a local park kupuna (elder) scooped Puffy up with a net and immediately put him into the water-filled action packer. We hurriedly escorted Puffy to the ocean. A couple of seconds passed and Puffy swam happily away. As I emerged soaking wet and smiling out of the fish pond, I knew we saved an overlooked tsunami victim.

The Rescue

Other areas along the coast suffered even more tsunami damage. A few water quality sampling locations along the Ala Kahakai National Historic Trail completely surprised us. Just one week after the tsunami, we drove down Ali'i Drive in Kailua and passed Kahalu'u Beach Park. There we noticed huge barricades and orange fencing. We quickly turned the vehicle around and went to investigate an established water quality site. The ocean breakwall had a gaping 3 meter hole. But worse, an important anchialine pool had doubled in size with extra salt water and filled in with sand and marine fish. The vegetation around the pool was also significantly damaged.

Fortunately, the County of Hawai'i with help from The Kohala Center, will restore the pool to its original form. This includes removing all of the non-native vegetation, rebuilding the wall, digging out the sand, and removing any animals that don't historically belong in that anchialine pool.

Puffy's rescue and the Kahalu'u Beach Park restoration project are stories of hope. But, as we continued our sampling in April, we went to another site along the Ala Kahakai NHT, also located on Ali'i Drive. We arrived smiling, happy, and in high spirits as we walked to what had been our sampling site (a sacred anchialine pool). I carefully looked around and said, "That's odd, I thought it was right here. I remember walking under this tree, and next to that stump was the pool." The stump was surrounded by large rocks, and when we looked closer we saw the remains of the anchialine pool; now a small puka (hole) with no water. It hadn't occurred to us that this pool could be filled in with coral and lava rocks from the tsunami. But there we were, staring at the rubble; flabbergasted. "Crazy" and "sad" were words we used to describe the scene. This special pool, highly valued by some Hawaiians, was now pau (finished). Perhaps the local man we call "Uncle", who watches over the pool, will be able to restore it.



All in all, many anchialine pools and wetlands along the Kona coast were significantly altered or destroyed. Fortunately, West Hawai'i nationals parks, the County of Hawai'i, and the local community are all giving helping hands to restore the damaged coast, and preserve the cultural and ecological integrity of these unique ecosystems.

—M. Jerolaman, aquatic volunteer

Lava, Fire, and Plants

Wildfires have a dramatic effect on Hawaiian landscapes (D'Antonio et al. 2000). Historically, wildfires were believed to be relatively small and infrequent (more than 700 years apart) in Hawaiian forests despite the presence of natural ignition sources such as lightning and lava flows (LaRosa et al. 2010). In 2002 and 2003, lava-ignited wildfires occurred in the East Rift forests of Hawai'i Volcanoes National Park, and were presumably intensified by drought and nonnative plant species that alter fuel loads and fire behavior.

Although many native species demonstrate some capacity to survive these fires (Ainsworth and Kauffman 2009), overall the fires appeared to encourage the establishment of nonnative plant species. Once established, these invasive species appeared to slow or alter recovery of native forests (Ainsworth and Kauffman 2010). Following the 2002/03 fires, managers and researchers hypothesized that future fires may continue to favor invasive species, possibly resulting in a conversion from native forest to nonnative shrublands similar to the conversions documented in the park's dry ʻōhiʻa woodlands (Vitousek and D'Antonio 1992).

In March 2011, the lava ignited Nāpau wildfire reburned substantial areas of previously burned forest in the East Rift wet forest of the national park and provided an excellent opportunity to examine the effects of repeated fires on native Hawaiian plants and forest birds. The East Rift forest has long been recognized for its rare plants and birds. The area also contains unique assemblages of native lowland wet forest plant species that serve as important seed sources for colonizing new lava flows.

Coincidentally, the Pacific Island Network Inventory and Monitoring Program (I&M) had just completed the initial implementation of the Focal Terrestrial Plant Communities, Established Invasive Plant Species, and Landbirds vital signs monitoring protocols in the East Rift forest in 2010. Specifically, field crews surveyed 18 vegetation community plots, 9 invasive plant species transects, and several bird transects in and near the affected area. Vegetation sampling surveys included unburned forests with ʻōhiʻa canopies and dense hāpuʻu subcanopies. The survey also included forests recovering from the 2002/03 fires with dead ʻōhiʻa canopies, recovering hāpuʻu tree ferns, and abundant invasive grasses.

These monitoring data were intended to provide park managers with information on the current status of the East Rift forests and enable them to detect changes over time with repeated monitoring every five years. The surveys were also designed to provide an important baseline from which to study the effects of events such as wildfires or hurricanes on park forests and their avian inhabitants. The 2011 Nāpau fire burned five newly established vegetation community plots, three invasive plants transects, and sections of three bird transects.

Immediately following the Nāpau fire, I&M and park resource management staff teamed up to assess the severity of the burn. Furthermore, this summer we will resurvey the vegetation plots and transects to document the initial vegetation response to the fire. Unlike previous fires in the East Rift, this time we have pre-fire data. Comparing before-and-after data greatly improves our ability to understand changes within these important forest communities. Further deepening our knowledge of the recovery of this area, these plots will again be resurveyed in four years as part of the standard monitoring cycle.

Inventory and Monitoring biotech assessing the burned forest floor

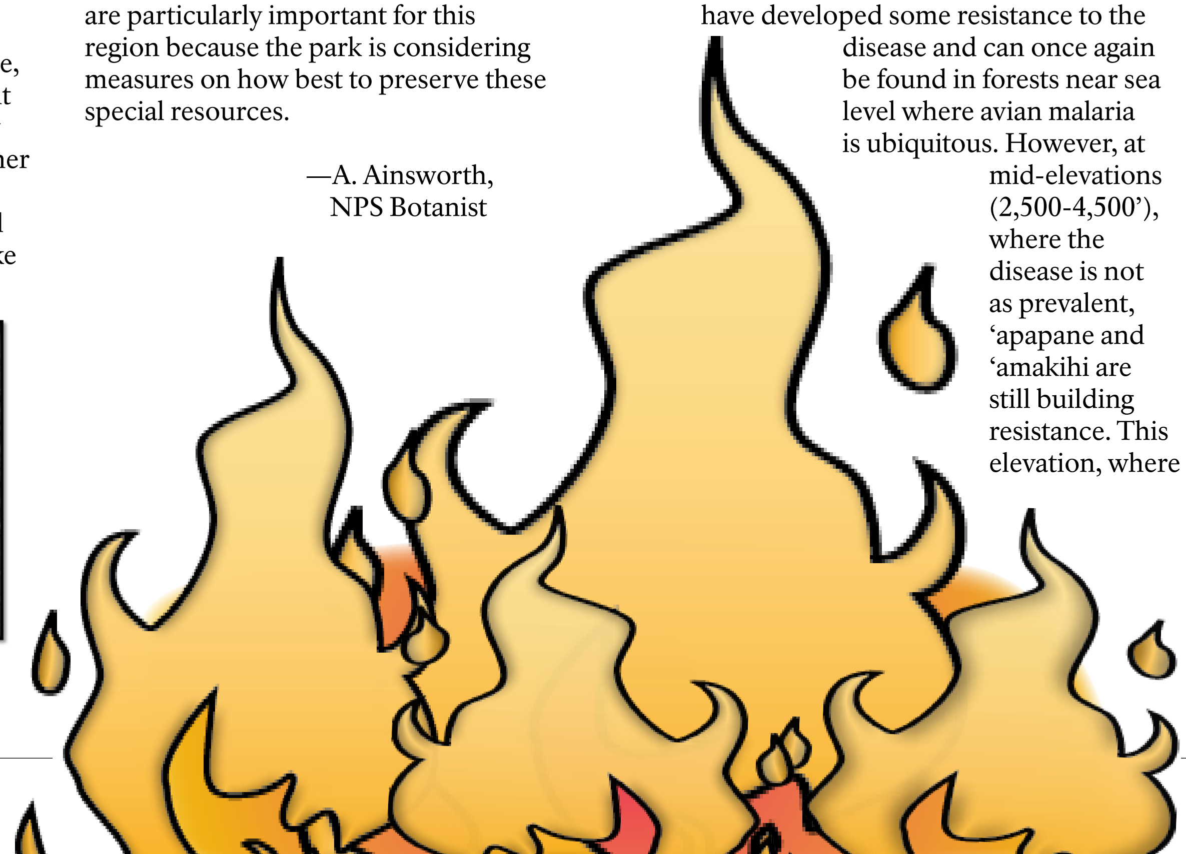
Current and accurate vegetation data are particularly important for this region because the park is considering measures on how best to preserve these special resources.

—A. Ainsworth,
NPS Botanist

Unburned

Burned in 2003　Photo from 2010

Burned in 2003 and 2011



Lava, Fire, and Birds

Rare native forest bird species such as ʻiʻiwi, ʻākepa, and ʻakiapōlāʻau are restricted to higher elevations in Hawaii; where, in the absence of mosquitoes, the birds can avoid the transmission of avian malaria. With the threat of climate change and higher mean temperatures, developing resistance to the parasite may be the key to survival for those species. Populations of ʻapapane and ʻamakihi, over decades of exposure to the parasite, have developed some resistance to the disease and can once again be found in forests near sea level where avian malaria is ubiquitous. However, at mid-elevations (2,500-4,500'), where the disease is not as prevalent, ʻapapane and ʻamakihi are still building resistance. This elevation, where native forest birds are still rebounding, is precisely where the Nāpau wildfire occurred in the East Rift of Hawai'i Volcanoes National Park.

The East Rift is an important transition zone, where birds more resistant to malaria may transfer their valuable genes to more vulnerable upland populations.

The East Rift contains 4,400 hectares of forest near the Nāpau and Makaopuhi craters, as well as part of the very active Puʻu ʻŌʻō vent that stirs just inside the park boundary. Volcanic activity has formed a mosaic of old and young native forests in this very dynamic landscape. The habitat is ideal for many birds which can exploit a variety of habitats for foraging and nesting. The NPS Pacific Island Network Inventory and Monitoring program periodically collects data on the distribution, density, and abundance of these birds along with data on vegetation communities and invasive plant species.

In the spring of 2010, almost one year before the Nāpau fire, the East Rift was surveyed for native and non-native forest birds. Crewmembers counted every bird seen and heard, as well as the distance from the observer to the bird; for an 8-minute period on established stations along transects. The transects are straight and long paths, and cross some of the densest and most isolated forests within the national park.

Bird abundance estimates in 2010 were generally positive for some native bird species. Over 44,000 ʻapapane, 5,000 ʻamakihi, and 2,000 ʻōmaʻo were estimated to be residing in the East Rift. No endangered species were detected, nor were the ʻiʻiwi or ʻelepaio. ʻAmakihi detections were surprisingly low, which may be an effect of malaria and/or the specie's preference for drier habitat. Common non-native species were also found; over 53,000 Japanese white-eyes are estimated to be using the area, and less than 1,000 each of northern cardinals and red-billed leiothrix were detected.

The Nāpau fire, which was started by the volcanic Kamoamoa fissure eruption on March 5, burned almost half of the East Rift forest just as fires did nearly ten years ago. With the removal of forest habitat, we may expect a decline in the occurrence of forest birds in the area. However, many birds returned following previous burns —but will this extreme event of repeated fires cause long-term permanent habitat degradation or loss? The baseline data we collected on the birds in 2010 will provide us necessary information to compare with future bird monitoring data in the area. This will give us an idea of the long-term impacts the fire had on these precious animals.

We can hope that the fire will have only short term impacts on bird habitat and that a native forest can reestablish. ʻŌmaʻo, in particular, are vital for the recovery and diversity of native forests because it is Hawaiʻi Island's only remaining native seed disperser.

Thankfully, this fire was contained before even more vital habitat was destroyed. There is some comfort that Pele was at the hand of such destruction, but the long-term impact of invasive-plant-fueled wildfires in a changing climate will only be deduced with consistent and regular vegetation and avian monitoring.

—S. Judge, CESU
Wildlife Biologist

A Slice of the Future Served on a Terra Cotta Plate

If you can drag yourself out of your warm bed two days after the April or May full moon in Hawaii, make your way to the nearest coral reef and jump into the chilly morning ocean water, your efforts may be rewarded with a natural show unlike any other. As you peer through the clear water, colonies of the coral *Pocillopora meandrina* will begin to emit a smoky substance, clouding the water around you with millions of sperm and eggs. This process is called broadcast spawning, and it is how most corals reproduce.

Approximately 80% of all corals are broadcast spawners (although *P. meandrina* is one of the few to spawn during the daytime). More rarely, corals brood their larvae. Whether coral larvae are brooded and then released or develop in the water column after broadcast spawning, they eventually must settle to the sea floor where they metamorphose into coral polyps. Some of these polyps will successfully undergo asexual division, and if they withstand predation and other stressors, will eventually recruit into the community of adult coral colonies with which we are familiar.

In Hawaii, sexual reproduction in most corals occurs in the spring and summer months, and PACN I&M scientists are there to study the process. As part of a larger effort to monitor the health of coral reefs in the Pacific over time, we want to understand when, where, and how many coral larvae settle on the reefs in national park waters.

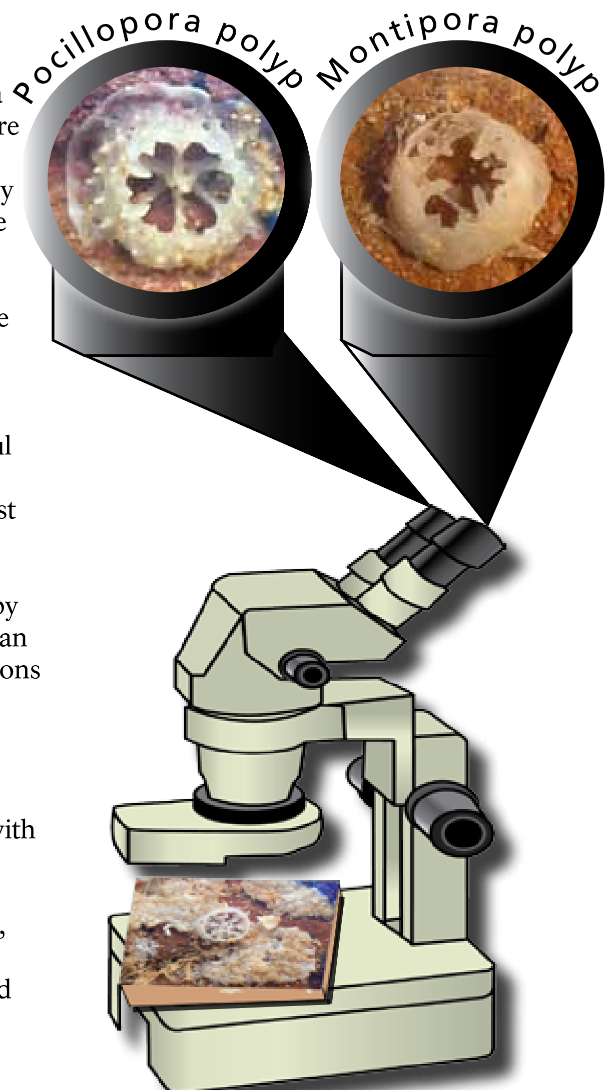
At Kalaupapa National Historical Park, we study coral settlement by providing coral larvae an artificial substrate on which they can settle. In April, before the peak spawning period, three terra cotta tile arrays are deployed at each of fifteen locations throughout the park's marine waters. Five months later, after most spawning has ceased, the arrays are collected, and any coral polyps settled on the tiles are counted under a microscope. We have studied settlement for the past five years, and corals from the genera *Porites*, *Pocillopora*, and *Montipora* are the most common species observed. The number of settlers has been fairly consistent over time, but a large spike in *Montipora* settlers was observed in 2008. Continued monitoring may help us understand what causes these periodic spikes in settlement.

Monitoring coral settlement is important because without successful sexual reproduction, settlement, and recruitment, coral reefs cannot persist over the long-term. The processes involved in sexual reproduction are extremely sensitive, and threatened by stressors like climate change and ocean acidification. So while adult populations may appear healthy, the persistence of these populations may still be at risk. For example, with the coral *Acropora palmata*, elevated seawater temperatures have been associated with larval developmental abnormalities and decreased settlement rates. In the same species, ocean acidification, caused by increased atmospheric carbon dioxide levels, has been found to reduce fertilization success and larval settlement.

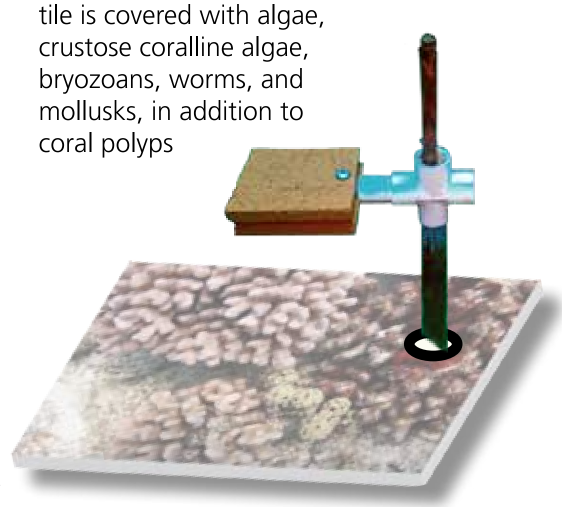
With the elevated atmospheric carbon dioxide levels predicted for the middle of this century, settlement success for this species is predicted to be reduced by more than 50%. Thus, in the coming years, coral reefs face even greater challenges for survival.

Monitoring coral settlement rates in our national parks, in addition to other monitoring activities, will help us keep track of the health of our reefs, and will allow us to make the educated decisions to protect and preserve these important ecosystems.

—K. Tice, NPS
Biological Science Technician



At the end of the five month deployment, the terra cotta tile is covered with algae, crustose coralline algae, bryozoans, worms, and mollusks, in addition to coral polyps



Coral settlement tile array